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M.R.P.1034A
March, 1957

METEOROLOGICAL OFFICE
31 MAY 1957
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Air Ministry

Meteorological Research Committee

Programme of Investigations 1957/58

1. Problems are classified under three main headings, viz:-

I. Development of Meteorological Instruments.

II. Investigations in Synoptic and Dynamical Meteorology and Climatology.

III. Physical Investigations.

2. The system of priority markings used in previous Programmes has been retained, viz:-

PX Exceptionally important and urgent investigations.

P1 Important and urgent investigations.

P2 Important investigations, but not particularly urgent.

/3.

G.17195/JEK/2/57/50(r)

3. The numbers of problems of each priority are shown in the following table.

Numbers of Problems

Nature of Problem	Section	Priority				
		PX	P1	P2	Not assigned	Total
Instruments	I	10	25	16	1	52
Synoptic and Dynamical Meteorology and Climatology	II	12	41	24	1	78
Physical	III	8	30	16	1	55
Total		30	96	56	3	185

4. A list of PX problems is shown overleaf.

5. Appendix 1 to the Programme shows the items of extra-mural research which are sponsored by the Meteorological Office. Appendix 2 lists the researches relevant to the atmosphere which are sponsored by the Gassiot Committee of the Royal Society with support from public funds. A few of these items have hitherto been mentioned in the Programme proper but are now omitted therefrom.

London,

March, 1957

Problems with priority PX

Item No.	Investigation
I.1.(a)(i)	Thermometer elements and indicators for use at all aircraft speeds and all heights, both in clear air and in cloud.
I.1.(c)	Recording apparatus for use with aircraft meteorological instruments.
I.5.(b)(i)	Design of equipment for measurement of slant visibility, for investigation purposes.
I.6.(a)(ii)	Determination of cloud height by day; application of modulated searchlight.
I.7.(a)(i)	Investigation of errors and improvement in accuracy of readings of pressure, temperature and humidity in Mk. IIB radio-sonde, and in technique of its use.
I.7.(a)(ii)	Development of meteorological elements for radar sonde.
I.7.(b)(ii)	Development of radar sonde theodolite.
I.12.(b)(ii)	Development of instruments for measuring size distribution of water particles in rain.
I.12.(c)	Development of airborne nucleus and particle samplers.
I.14.(b)	Development of transportable meteorological observing unit.
II.1.(c)	Value of radar in weather forecasting and techniques for its operational use.
II.4.(d)	Orographic influences on air flow.
II.5.(a)	Variations in the large-scale circulation patterns of the troposphere (and when practicable the lower stratosphere) with 'periods' up to about one month using time-mean charts as appropriate.
II.5.(b)	Variations in weather conditions over the British Isles with 'periods' up to about one month and their relationship with the large-scale circulation.
II.7.(a)(ii)	Factors associated with development, intensity and duration of depressions, especially the deepening of depressions over the Atlantic and associated changes of movement.
II.7.(f)	Estimating and forecasting winds at 30,000 to 50,000 feet - over the Atlantic, Europe (including Russia), Mediterranean and Middle East.
II.7.(i)	Statistical study of surface developments following the appearance of specified thickness (or contour) patterns; e.g., frequency and magnitude of increases in intensity of depressions moving south-eastwards in a north-westerly thermal.
II.7.(j)	Statistical study of upper air developments associated with the appearance of specific surface patterns; e.g., thickness patterns prior to the deepening of a depression by at least 20 mb in 24 hours.

FG1A

Item No.	Investigation
II.8.(c)	Factors contributing to large errors in forecast positions of fronts.
II.10.(a)	Application of computing machinery to forecasting problems: the numerical solution of the dynamical equations in specified synoptic situations.
II.12.(a)	World topography of isobaric surfaces; seasonal variation, characteristics of seasons and years; distribution and variability of winds.
II.13.(f)	Areal distribution of intense falls of rain (Cardington).
III.2.(d)(i)	Physical structure of rain-producing clouds, including nature and growth of precipitation elements.
III.2.(d)(iv)	Artificial production of rain and dispersal of cloud.
III.2.(f)	Meteorological factors affecting contrails.
III.3.(a)	Air movement in and near convective clouds.
III.3.(b)(i)	Instrumental and other observations from aircraft. Relationship with synoptic conditions.
III.3.(f)(ii)	Experimental study of atmospheric diffusion of matter: medium range (distances up to about 100 miles).
III.7.(a)	Relation between slant and horizontal visibilities (in relation to the landing of aircraft).
III.8.(b)	Variation of wind in and around jet streams.

Meteorological Research Programme

M.R.P. 1034 Part I

Note: In the "Latest Papers" column an asterisk indicates an M.R.P. which has been approved for distribution. Where appropriate the Branch, station or individual primarily responsible for a particular problem is underlined.

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
	I. Development of Meteorological Instruments and Observing Technique			
I.1	Temperature and humidity, measurement and recording			
	(a) (i) Thermometer elements and indicators for use at all aircraft speeds and all heights, both in clear air and in cloud.	PX	M.O.17, M.R.F.	M.R.P. 822*, 930*, 960*
	(ii) Improvement of existing meteorological instruments for aircraft.	P1	M.O.17	M.R.P.744
	(b) Design of hygrometers			M.R.P. 977*, 983
	(i) Electrical absorption type.	P2	M.O.16., M.O.17	M.R.P. 240*
	(ii) Hoar frost point type, extension to photo-electric, to automatic cooling and heating and to automatic recording for use in aircraft.	P1	M.O.17 Dr. Brewer M.R.F.	M.R.P. 774*, 859*, 877*
	(iii) Frost point type using polarized light.	P1	M.O.17	M.R.P. 661*

/(c)

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
I.1	(c) Recording apparatus for use with aircraft meteorological instruments.	PX	M.O.17, M.R.F.	
I.2	Pressure, measurement and recording			
	(a) Precision surface aneroid for use in place of mercury barometer, especially for mobile purposes.	P1	M.O.16	M.R.P.623
	(b) Use of hypsometers as a means of measuring surface pressure for calibration purposes.	P1	M.O.16	
I.3	Wind, measurement and recording			M.R.P.974* (vertical gustiness recorder), 1010*
	(a) The exposure of anemometers: field and wind tunnel investigations.	P2	M.O.16	M.R.P.989, 1032*
I.4	Rain and snow, measurement and recording			
	(a) Recording gauges and observing technique for measuring intensity and frequency of rainfall.	P1	M.O.16	
	(b) Measurement of rainfall on ships.	P1	M.O.16	M.R.P.880
	(c) Monthly rainfall recorder.	P2	M.O.16	
	(d) Snow gauges and recorders.	P1	M.O.16	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
I.5	Visibility, measurement and recording			M.R.P.1033*
	(a) Design of visibility meter on scattered light principle or other method suited for use on ships and/or aircraft.	P2	M.O.16 M.R.F.	See also III.7.(b)
	(b) Design of equipment for measurement of slant visibility.		M.O.16	M.R.P.403. See also III.7.(a), II.2.(d)
	(i) for investigation purposes	PX		M.R.P.738, 943*
	(ii) for airfield use.	P1		
	(c) Development of night visibility meter using matching instead of extinction criterion.	P1	M.O.16	M.R.P.997*
	(d) Development of liquid water content meter for fog.	P2	Kew	See also III.2.(c)(i)
I.6	Cloud height and amount, measurement and recording			
	(a) Determination of cloud height by day			
	(i) Pulsed light method.	P2	M.O.17	M.R.P.941*
	(ii) Application of modulated searchlight.	PX	M.O.16	
	(b) Investigation into the methods of estimating amounts of low cloud at night.	P1	M.O.16	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
I.7	Radio-sonde and radar wind instruments and equipment			
	(a) Temperature, humidity and pressure			
	(i) Investigation of errors and improvement in accuracy of readings of pressure, temperature and humidity in Mk.IIB radio-sonde, and in technique of its use.	PX	M.O.17 M.O.12	M.R.P. 888, 889*
	(ii) Development of radar sonde, including meteorological units, calibration equipment, observing technique and investigation of accuracy of the system.	PX	M.O.17 M.O.12	M.R.P. 850
	(iii) Development of low level sonde.	P1	M.O.17	Required for fog and low st. forecasting and for radio propagation data
	(iv) Development of ionisation method of measuring air density.	-	University College, Aberystwyth	Research contract
	(b) Wind			
	(i) Improvement of G.L.III and adaptation of G.L.VII for wind measurements.	P1	M.O.17	M.R.P. 513, 672, 922*
	(ii) Development of radar sonde theodolite.	PX	M.O.17	
	(iii) Investigation of errors in wind measurements.	P2	M.O.17 M.O.12	M.R.P. 406*, 1021*
	(iv) Improvement of equipment for use on ships.	P1	M.O.17	M.R.P. 508, 928*

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
I.7	(c) Miscellaneous items			
	(i) Improvement of radio-sonde and radar wind auxiliary equipment.	P1	M.O.17	M.R.P.341* See also III.10.(b)
	(ii) Development of attachment to measure vertical currents.	P2	M.O.17	
	(iii) Development of hydrogen generators.	P1	A.D.(Eng.)C.G. M.O.16	
	(iv) Development of radio-sonde for potential gradient measurement.	P2	M.O.17	Work in progress at Clarendon Laboratory, Oxford, on behalf of Admiralty: with flight trials at Crawley.
I.8	Thunderstorms, rainstorms, etc., location of			
	(a) Improvement of R.D.F. technique for locating thunderstorms.	P1	M.O.12	
	(b) Development of radar equipment on millimetric wavelength for observation of cloud and precipitation.	P2	M.O.17	
I.9	Instruments for use at sea			
	(a) Investigation of errors due to limitations of exposure.	P1	M.O.1, M.O.16	M.R.P.481*, 880
	(b) Remote indicating and recording dry and wet bulb thermometers for use on ships.	P1	M.O.16	
	(c) Development of instrumentation for measurements of air temperature and humidity gradients and sea temperature gradients at Ocean Weather Stations.	P2	M.O.16 M.O.1	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
I.10	Adaptation of instruments and equipment for tropical and polar use			
	(a) Adaptation of standard instruments for polar and tropical conditions with special regard to protection of moving parts and to providing adequate exposure.	P2	M.O.16 M.O.17	
I.11	Radiation			
	(a) Development of daylight illumination recorder, eliminating cosine law and temperature corrections.	P2	Kew	M.R.P. 988*
	(b) Study of new types of instruments for the automatic integration of solar radiation, as they become available.	P1	Kew	M.R.P. 862*
I.12	Cloud micro-physics			
	(a) Development of instruments for measuring water content in clouds and in rain.	P1	M.R.F.	Related to III.2(b)(i) and (e) M.R.P. 737*, 916*
	(b) Development of instruments for measuring size distribution of water particles		M.R.F.	Related to III.2(b)(ii), d(iii) and (e)
	(i) in cloud (ii) in rain.	P2 PX		
	(c) Development of airborne nucleus and particle samplers.	PX	M.R.F.,Porton	Important to item III.3(f)
I.13	Micro-meteorology			
	(a) Instrumentation for microclimatology.	P1	M.O.16 Cambridge Kew	M.R.P. 883*
	(b) Development of recorder for surface aerodynamic drag.	P1	Cambridge	
	(c) Improvement of flux plates for measuring heat flow in soil.	P2	Kew	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
I.14	Instruments for other special purposes			
	(a) Development of means of obtaining winds up to 2,000 feet above ground in conditions of low cloud.	P2	A.D.M.O.(I.D.)	
	(b) Development of transportable meteorological observing unit.	PX	M.O.16	
	(c) High atmosphere exploration.			
	(i) Development of high altitude searchlight.	P1	M.O.16	M.R.P. 906, 937, 938; R.R.E. Memo. 1136. See III.10(a)
I.15	Improvement of existing meteorological surface instruments.	P1	M.O.16	

Meteorological Research Programme
M.R.P. 1034 Part II

Note:- In the "Latest Papers" column an asterisk indicates an M.R.P. which has been approved for distribution.

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
	II. Synoptic and Dynamical Meteorology and Climatology			
II.1	Examination of Forecasting Technique generally			
	(a) Development of a system for checking the accuracy of forecasts and to determine in particular the frequency and magnitude of the errors of the component parts.	P1	A.D.M.O.(F.R.) M.O. 2	M.R.P. 788*
	(b) Techniques for the construction of surface prebaratic charts with special reference to the systematic use of extrapolation.	P2	M.O. 21	
	(c) Value of radar in weather forecasting and techniques for its operational use.	P X	M.O. 21	M.R.P. 1009*, 1022*
II.2	The Forecasting of Fog			
	(a) Radiation fog, its formation, persistence and dispersal, including fog in tropical regions.	P1	M.O. 21 Kew	M.R.P. 742*, 971*
	(b) Advection fog and the influence of the thermal properties of the ground and sea.	P1	M.O. 21 M.O. 1	M.R.P. 435
	(c) Geographical distribution of smoke pollution and its effect on fog formations.	P1	A.D.M.O.(S.I.) A.D.M.O.(F.R.)	
	(d) The variation of visibility at small heights.	-	-	Awaiting progress of items I.5(b) and III.7(a)
	(e) Visibility within the fog range.	P1	M.O. 21	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.3	The Forecasting of Cloud and Precipitation			
	(a) Convectional cloud and precipitation.		M.O. 21	
	(i) Distribution of showers over the British Isles in relation to the synoptic situation.	P1		
	(ii) Nocturnal precipitation, especially important in the tropics.	P2		
	(b) A synoptic statistical investigation of medium and high cloud.	P2	M.O. 21	M.R.P. 633*
	(c) Factors governing the formation and dispersal of low stratus cloud over the British Isles, and in tropical regions.	P1	M.O. 21	
	(d) Incidence, duration and intensity of rain over the British Isles; e.g., forecasting the variations with time of a warm-front rain belt.	P1	M.O. 21	M.R.P. 748*, 762*, 816*, 843*, 1022*
	(e) Conditions favourable for snow, especially substantial falls in different parts of the British Isles.	P1	M.O. 21	
	(f) Depth and upper level of cirrus cloud.	P1	M.O. 21 D.D.M.O.(S)	M.R.P. 727*, 833*, 933* See also III.2(b)(iii)
	(g) Three-dimensional representation of atmospheric humidity.	P1	M.O. 21	
	(h) Formation and dispersal of stratocumulus cloud.	P1	M.O. 21	M.R.P. 913*
	(i) Height of cloud base (or vertical visibility) in precipitation.	P1	A.D.M.O.(F.R.)	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.4	Investigation of Local and Topographical Characteristics			
	(a) Behaviour of fronts on encountering obstacles such as high mountains.	P2	M.O. 21	
	(b) Fohn effect of the Welsh mountains on the West Midlands.	P2	A.D.M.O.(F.R.)	
	(c) Land and sea breezes in relation to topography,	P2	A.D.M.O.(F.R.) A.D.M.O.(S.I.)	
	(d) Orographic influences on air flow.	PX	M.O. 21 Imperial College, London	M.R.P. 842*, 886, 892, 907, 935*, 939*, 985*, 999, 1015*, 1025* Research contract (experiments on models)
	(e) Problems of local forecasting with special reference to cloud base, visibility and wind in the lower layers.	P1	M.O. 21	
II.5	Investigations relating primarily to long range forecasting			
	(a) Variations in the large-scale circulation patterns of the troposphere (and when practicable the lower stratosphere) with 'periods' up to about one month using time-mean charts as appropriate.	PX	M.O. 22	M.R.P. 917*, 994*, 1005*
	(b) Variations in weather conditions over the British Isles with 'periods' up to about one month and their relationship with the large-scale circulation. (The term 'period' implies a measure of the time-scale of the variations and does not necessarily connote any regular periodicity.)	PX	M.O. 22 Bedford College, London	M.R.P. 915*, 970*, 1023 Research contract (standard calendar of London daily meteorological observations 1723 to 1800 and possibly thereafter)

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.6	Investigations relating primarily to medium range forecasting			
	(a) Large-scale circulation types: classification.	P1		M.R.P. 834*
	(b) Changes of type and persistence of type, particularly of dry spells in the British Isles in different seasons.	P1		M.R.P. 837*
	(c) Zonal, meridional and other indices.	P2	M.O. 22	M.R.P. 591*
	(d) Development, movement and decay of major synoptic features (according to season and location) in the Northern Hemisphere.	P1		M.R.P. 752*
	(e) Modes of behaviour of the long-wave upper air pattern, such as: rapid changes from zonal to meridional flow; breakdown of blocking situations; weakening and strengthening of thermal troughs, quantitative criteria to assist in forecasting downstream trough formation; breakaway of small troughs from long-wave troughs.	P1		
II.7	Investigation of circulation problems relating primarily to short range forecasting.			
	(a) Development and structure of depressions		M.O. 21	
	(i) Temperature and wind structure and their changes throughout the life history of the depression.	P1		

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.7	(ii) Factors asociated with development, intensity and duration, especially the deepening of depressions over the Atlantic and associated changes of movement.	PX		M.R.P. 829*, 872*
	(iii) Factors related to the origin of depressions, e.g., the topography of the tropopause and jet streams.	P1		
	(iv) Factors governing the speed and direction of travel of depression centres and of complex systems of two or more depressions.	P1		
	(v) Conditions and places of origin of depressions, in particular seasons and years.	P1		
	(b) Anticyclones	P1	M.O. 21	
	(i) Factors associated with the formation, development, intensity and persistence of anticyclones.			M.R.P. 755*
	(ii) Anticyclogenesis in relation to the general synoptic situation.			
	(c) Inter-relation of vorticity, divergence and vertical motion, including special conditions in low latitudes.	P2		M.R.P. 829*
	(d) Upper winds and contour patterns (including the 200 and 100 mb. levels), jet streams in particular.	P2	M.O. 21	M.R.P. 861*, 888, 932* See also III.8(b)
	(e) Temperature changes and relative importance of advection, dynamical and non-adiabatic processes, in the synoptic problem.	P1		M.R.P. 775*, 1005*

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.7	(f) Estimating and forecasting winds at 30,000 to 50,000 feet - over the Atlantic, Europe (including Russia), Mediterranean and Middle East.	PX	A.D.M.O.(F.R.) M.O. 9 Bomber Command	
	(g) The forecasting of winds in low latitudes.	P1	A.D.M.O.(F.R.)	
	(h) Pressure surges over large areas.	P2	A.D.M.O.(F.R.) A.D.M.O.(C.R.)	
	(i) Statistical study of surface developments following the appearance of specified thickness (or contour) patterns; e.g., frequency and magnitude of increases in intensity of depressions moving south-eastwards in a north-westerly thermal.	PX	M.O.21	
	(j) Statistical study of upper air developments associated with the appearance of specific surface patterns; e.g., thickness patterns prior to the deepening of a depression by at least 20 mb in 24 hours.	PX	M.O.21	
II.8	Frontology			
	(a) Three-dimensional structure of fronts in relation to temperature, humidity and wind, with special reference to clouds and rainfall.	P1	M.O. 21 M.R.F.	M.R.P. 807*
	(b) Frontogenesis and frontolysis; cases where relevant upper air information is available.	P2	M.O. 21	M.R.P. 896*
	(c) Factors contributing to large errors in forecast positions of fronts.	PX	M.O. 21	
	(d) Fronts in the tropics.	P1	A.D.M.O.(F.R.) A.D.M.O.(C.R.)	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.9	Variations in space and time of sea surface temperature in relation to synoptic situation.	P1	M.O. 1 A.D.M.O. (F.R.)	M.R.P. 723, 949*, 1005*
II.10	Application of Computing Machinery to Forecasting Problems			
	(a) The numerical solution of the dynamical equations in specified synoptic situations.	PX	A.D.M.O. (F.R.)	M.R.P. 863*, 866, 893, 934, 986*, 1002*, 1003*, 1016*, 1018
	(b) The development and use of regression equations for forecasting:-			
	(i) Upper winds.	P2	Mr. Durst A.D.M.O. (C.F.)	M.R.P. 756*, 776*, 953*, 955*, 987*
	(ii) Other items.	P2	Mr. Durst A.D.M.O. (C.F.)	
	(c) Numerical methods of interpolating and extrapolating on the synoptic scale from observations of pressure, temperature and wind.	P1	A.D.M.O. (F.R.)	M.R.P. 965*, 986*, 1016*
II.11	Forecasting ice formation on railway conductor rails in England.	P1	D.D.M.O. (F.)	
II.12	World Climatology and the General Circulation			
	(a) World topography of isobaric surfaces; seasonal variation, characteristics of seasons and years; distribution and variability of winds.	PX	M.O. 23	M.R.P. 819*, 821*, 823*, 860*, 869*, 918*, 925*, 981*, 1020*
	(b) World topography of the tropopause; simple and multiple tropopauses, types of tropopause; large scale air movements in the stratosphere and upper troposphere; exchange of mass between the stratosphere and troposphere.	P1	M.O. 23	M.R.P. 874*, 924*, 978*

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.12	(c) Distribution, inter-relation and persistence of anomalies of pressure, temperature and rainfall in different parts of the world; study of CLIMAT and CLIMAT TEMP data.	P1	A.D.M.O.(C.R.)	M.R.P. 994*
	(d) The energy exchange between the atmosphere and the ocean.	P2	A.D.M.O.(C.R.) M.O. 1, M.O.22	M.R.P. 949*, 1005*
	(e) Relation between solar conditions and terrestrial conditions.	P2	A.D.M.O.(C.R.) Edinburgh	
	(f) Climatic changes and trends.	P2	M.O. 18 A.D.M.O.(C.S.)	
	(g) World distribution of water vapour.	P1	M.O. 18 M.O. 23	
II.13	Regional and Synoptic Climatology			
	(a) Climatological features of specified areas.	P2	A.D.M.O.(S.I.) M.O. 18	M.R.P. 554*, 694, 723, 729*, 770*, 778*, 789*, 923*
	(b) Climatological features of certain regions and major centres of population in the British Isles, including synoptic aspects.	P1	M.O. 3 Bedford College, London	Research contract (see II.5(b))
	(c) Climatological statistics in terms of weather types.	P1	A.D.M.O.(C.S.)	M.R.P. 834*, 871
	(d) Frequencies, for selected stations in Great Britain and overseas, of associated dry and wet bulb temperatures, based on hourly observations.	P2	M.O. 3 M.O. 18 M.O. Edinburgh	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
II.13	(e) Occurrence, base, height, intensity and thickness of temperature inversions and the associated humidity lapse rate at all levels up to the tropopause in relation to synoptic situation, particularly in maritime regions.	P1	M.O. 1 A.D.M.O.(S.I.)	In connection with radio and radar propagation. In collaboration with Admiralty representative on T.W.P.C.
	(f) Areal distribution of intense falls of rain (Cardington).	PX	M.O. 3	
	(g) Variation of intensity-duration-frequency distribution of heavy falls of rain.	P1	M.O. 3 M.O. 15	M.R.P. 645
II.14	Applied Climatology			
	(a) Agriculture and Horticulture			
	(i) Statistical investigations in climatology.	P2	M.O. 19 M.O. Edinburgh	
	(ii) The liability to frost of particular localities.	P1	M.O. 19	
	(b) The hydrological cycle with particular reference to:		M.O. 3	
	(i) available yield for water works	P1		
	(ii) drainage and flood problems for River Boards.	P1		
	(c) Climatological statistics with respect to the building and engineering industries, for selected stations in Great Britain and overseas.	P2	M.O. 3 M.O. 18	
	(d) Factors affecting ground conditions for traffic.	P2	Mr. Durst	In collaboration with Rothamsted.

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.P.s., Remarks, etc.
II.15	Marine Meteorology			
	(a) Seasonal and secular variation of sea surface temperature.	P2	M.O. 1 M.O. 18	M.R.P. 923*, 949*, 1005*
	(b) Variation of meteorological elements over the ocean.	P2	M.O. 1	M.R.P. 949*
	(c) Variation of wind with height in the first few thousand feet over the sea and the relation between surface and geostrophic wind velocity.	P2	M.O. 1 A.D.M.O.(F.R.)	
	(d) Wave statistics for Ocean Weather Ships in relation to meteorological factors.	P1	M.O. 1	

Meteorological Research Programme
M.R.P. 1034 Part III

Note: In the "Latest Papers" column an asterisk indicates an M.R.P. which has been approved for distribution.

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
	III. Physical Investigations			
III.1	Vertical gradients of temperature, humidity and wind in the lower troposphere			
	(a) Analysis of continuous records of temperature and humidity up to heights of 350 feet.	P2	M.O.15	M.R.P. 546*
	(b) Detailed temperature, humidity and wind profiles over land.	P2	M.O.15 Cardington	Observations being made from captive balloon. M.R.P. 382
	(c) Gradients of temperature, humidity and wind over the sea.	P1	M.O.1 Porton	In collaboration with D.N.W.S. M.R.P. 714*, 725*
III.2	Micro-physics of water in the atmosphere			
	(a) Atmospheric nuclei Number and nature of condensation freezing and sublimation nuclei at ground level and at various heights in the atmosphere and investigation of condensation and sublimation of water vapour at very low temperatures.	P1	A.D.M.O.(P.R.) M.R.F. Porton	M.R.P. 702*, 998*, 1012*
	(b) Clouds (i) Liquid water and ice-crystal content in clouds.	P1	M.R.F.	M.R.P. 737*, 826*, 980* See also I.12(a)

/(ii)

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Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
III.2	(ii) Drop and ice-crystal size distribution in clouds.	P1	M.R.F.	M.R.P. 559*, 627*, 639*, 826*, 980*, 991*. See also I.12(b)(i)
	(iii) Cirrus cloud - height and temperature of base and top; structure.	P2	M.R.F.	See also II.3(f). M.R.P. 727*, 833*, 933*
	(iv) Millimetric radar studies of developments of cloud.	P2	East Hill	
	(v) Physical structure of stratocumulus cloud.	P1	M.R.F. M.O. 21	See also II.3(h). M.R.P. 913*
	(c) Fog			
	(i) Liquid water content and size distribution of water particles in fogs.	P1	Kew Cardington	See also I.5(e)
	(ii) Physical conditions leading to the formation of fog.	P1	Kew Cardington	M.R.P. 912*, 971*
	(d) Precipitation			
	(i) Physical structure of rain-producing clouds, including nature and growth of precipitation elements.	PX	M.R.F. East Hill	M.R.P. 458*, 683*, 954, 1009*, 1019*
	(ii) Development and travel of precipitation systems - belts or fronts, sporadic precipitation, small secondary depressions.	P1	East Hill	M.R.P. 1022*
	(iii) Drop size distribution in rain.	P1	M.O. 15 M.R.F.	M.R.P. 452*, 453*, 519 See also I.12(b)(ii)
	(iv) Artificial production of rain and dispersal of cloud.	PX	M.O. 15 M.R.F. Porton	M.R.P. 854*, 870, 876, 927, 931*, 975, 982, 992
	(v) Relation between radar echo intensity and rate of rainfall.	P1	East Hill	M.R.P. 984*

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
III.2	(e) Ice accretion on aircraft Meteorological factors affecting ice accretion on aircraft.	P1	M.R.F. M.O.15	Met.Rept. No. 9, M.R.P. 1017*. See also I.12(a), (b)
	(f) Contrails Meteorological factors affecting contrails.	PX	M.R.F. M.O.15	M.O. 479 (revised), M.R.P. 805, 830*, 832, 979*, 990*, 996*
	(g) Atmospheric electricity Electrical charges on, and field changes during, precipitation both near the surface and up to, and in, cloud.	P2	Kew	
III.3	Atmospheric turbulence			
	(a) Air movement in and near convective clouds; to include measurements of turbulence, vertical currents and entrainment of air, with special attention to measurements in other parts of the world.	PX	M.O. 15 M.R.F. East Hill	M.R.P. 820*, 826*, 875*, 919*, 980*
	(b) Upper air turbulence			
	(i) Instrumental and other observations from aircraft. Relationship with synoptic conditions.	PX	M.R.F. M.O.15	M.R.P. 827*, 828*, 868*
	(ii) Camera obscura measurements on smoke puffs and radar measurements on "window" at a range of heights.	P2	East Hill M.R.F.	M.R.P. 784
	(c) Temperature and humidity inhomogeneities in the atmosphere.			
	(i) Measurement of temperature fluctuations at heights above 30,000 ft., using Canberra aircraft.	P1	M.R.F.	For radio propagation studies
	(ii) Measurement of variations in refractive index at heights below 30,000 ft., by microwave refractometer in Hastings aircraft.	P1	M.R.F.	
	(iii) Radar echoes from clear skies ('angels').	P1	East Hill	

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
III.3	(d) Small scale turbulence in the lower atmosphere, including transfer of heat, momentum and water vapour.	P1	Cambridge Kew Porton	M.R.P. 724*, 735*, 740*, 808*, 873*, 884, 972*. See also III.6(a)
	(e) Laboratory investigation of natural convection.	-	-	M.R.P. 818*
	(f) Experimental study of atmospheric diffusion of matter.			M.R.P. 969
	(i) Short range.	P1	Porton	M.R.P. 1006*
	(ii) Medium range (distances up to about 100 miles).	PX	Porton, M.R.F.	M.R.P. 940, 1008
	(iii) Eddy structure and vertical diffusion in the first few thousand feet.	P1	Porton	M.R.P. 961*
	(iv) Wind tunnel studies of diffusion.	P1	Dr. Batchelor Porton	M.R.P. 973*
	(g) Theoretical study of mechanics of turbulent diffusion.	P1	Dr. Batchelor Porton	
	(h) Diffusion of pollution from chimneys.	P2	A.D.M.O. (S.I.)	M.R.P. 878*, 878A, 952*
	(i) Surface stress, especially over water (see also III.3(d)).	P2	Kew Cambridge Porton	M.R.P. 626*, 656, 678
III.4	Radiation			
	(a) Solar radiation - total, diffuse and according to spectral region.	P2	Kew	M.R.P. 862*, 894*, 895*. Radiation on horizontal surface also being measured at Eskdalemuir, Lerwick, Aberporth, Cambridge, and Victory House, London. See also I.11.

/(b)

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
III.4	(b) Measurement of flux of long wave (greater than 3μ) atmospheric radiation (from atmosphere and ground).	P2	Dr. Brewer Kew	M.R.P. 914*, 936*
	(c) Analysis of records of daylight illumination.	P2	Kew	M.R.P. 831*
	(d) Albedo of earth's surface and cloud.	P1	M.R.F., Kew	M.R.P. 929*
III.5	Factors governing the propagation of short-wave radio transmissions	P1	M.O. 15	In collaboration with the T.W.P.C. See item III.3(c)
III.6	Meteorological factors affecting agriculture			
	(a) Experimental study of microclimatology.	P1	Cambridge M.O.19	See also III.3(d). M.R.P. 724*, 797*, 972*
	(b) Measurement of water deposited in dew and hoar frost.	P2	Cambridge	
	(c) Liability to frost of particular localities.	P1	M.O.19	See also II.14(a)(ii)
	(d) Climate under glass.	P2	M.O.19	
	(e) Effect of barriers on the micro-climate of an adjacent area.	P2	M.O.19 M.O. Edinburgh	
III.7	Study of visibility from the air			
	(a) Relation between slant and horizontal visibilities relation to the landing of aircraft	PX	M.O.15	M.R.P. 568, 738, 912*. See also I.5(b)
	(b) Visibility from aircraft to aircraft, its variation with height and in cirrus cloud.	P2	M.O.15 D.D.M.O.(S)	M.R.P. 548. See I.5(a)

/(c)

Item No.	Investigation	Priority	Branch, Station or Individual	Latest M.R.Ps., Remarks, etc.
III.7	(c) Visibility of ground from aircraft at great heights and above cirrus cloud.	P1	A.D.M.O. (S.I.)	M.R.P. 568, 569
	(d) Ground-to-air visibility of aircraft in or above cirrus cloud.	P1	D.D.M.O. (S)	
III.8	Observations in the upper troposphere and lower stratosphere			See also III.3(c)(i)
	(a) Temperature, water content and ozone under various conditions.	P1	M.R.F.	M.R.P. 813*, 817*, 877*, 932*, 946*, 976*
	(b) Variation of wind in and around jet streams.	PX	M.R.F.	See also II.7(d)
III.9	The ionosphere and magnetic conditions Possible relationships between the radio reflecting conditions of the ionosphere and the prevailing terrestrial magnetic conditions.	P2	A.D.M.O. (P.R.) M.O. Edin.	
III.10	Observations at great altitudes			
	(a) Exploration of the high atmosphere by searchlights.	P1	M.O. 16	See I.14(c)(i)
	(b) Exploration of the high atmosphere by balloons.	P1	A.D.M.O. (I.D.) M.O. 12	See also I.7(c)(i)
III.11	Atmospheric chemistry			
	(a) Obtaining samples of air and rainfall at 6 Meteorological Office stations (for analysis elsewhere).	P1	A.D.M.O. (P.R.)	M.R.P. 993, 1014*
	(b) Obtaining samples of precipitation and cloud water during flight (for analysis elsewhere).	P1	M.R.F.	

Meteorological Research Programme 1957-58

Appendix 1

Extra-mural research sponsored by the Meteorological Office

Relevant item of Programme	Particulars
I.7(a) (iv)	Development of an ionization method of measuring air density Directed by Mr. E. M. Job, University College of Wales, Aberystwyth.
II.4(d)	Research on air flow over hills, using models Directed by Dr. R. S. Scorer, Imperial College of Science and Technology, London.
II.5(b) II.13(b)	Preparation of a standard calendar of London daily meteorological observations, initially for the period 1723-1800 with the prospect of extension to the present day Directed by Professor G. Manley, Bedford College, London.

Meteorological Research Programme 1957-58

Appendix 2

Researches sponsored by the Gassiot Committee of the Royal Society (1956)

It is thought that it will assist members of the Meteorological Research Committee and of the Sub-Committees in their consideration of the Programme of Research, to be aware of the work sponsored by the Gassiot Committee. The programme of this body is concerned with the characteristics of the upper atmosphere, and includes theoretical studies, experimental studies, and the development of instruments. It thus supplements and partly overlaps the programmes of both S.C.I and S.C.III, although it is largely devoted to subjects outside the fields of these Sub-Committees.

I. The measurement of atmospheric ozone and other gases and their relationship to meteorological conditions	
I.1 Maintenance of a world-wide ozone survey	Sir Charles Normand and Dr. G. M. B. Dobson (Ozone Commission of the International Association for Meteorology).
I.2 Vertical distribution of ozone; development of chemical methods	Dr. A. W. Brewer, Oxford.
I.3 Vertical distribution of ozone; development of improved infra-red spectroscopic methods	Dr. R. M. Goody, Imperial College.
I.4 Development of an infra-red spectrometer for use in aircraft	Dr. J. T. Houghton, R.A.E.
I.5 Study of atmospheric constituents, including distribution of ozone, by spectroscopic methods	Dr. T. W. Wormell, Cambridge. Dr. R. M. Goody, Imperial College.
II. Studies of atmospheric radiation	
II.1 Theory of atmospheric scattering	Mr. D. B. Lake, Kew Observatory.
II.2 Calculations on radiative heat - exchanges in the atmosphere	Mr. A. R. Curtis, Sheffield University.
II.3 Analysis of atmospheric emission of radiation by spectroscopic methods	Dr. R. M. Goody, Imperial College.
II.4 Radiation studies in field laboratory	Professor P. A. Sheppard and Mr. W. T. Roach, Imperial College.
III. Laboratory and theoretical studies	
III.1 Experimental study of molecular spectra	Professor R. W. P. Pearse, Imperial College.
III.2 Excitation of spectra - measurement of electron optical excitation functions	Professor H. S. W. Massey and Dr. D. W. O. Heddle, University College, London.
III.3 Study of photochemical reactions of possible importance in the atmosphere	Professor D. R. Bates and Dr. H. Mackle, Queens University, Belfast.

/III.4

	III.4 The measurement of absorption cross-sections in ultra-violet region	Professor R. W. Ditchburn, Reading University.
	III.5 Theoretical study of physical processes in the upper atmosphere	Professor D. R. Bates, Queens University, Belfast.
IV	Observational and laboratory study of airglow and auroral phenomena	Dr. Armstrong, Armagh Observatory, Professor Bates and Professor Emeleus, Queens University, Belfast.
V	Study of high-altitude atmospheric winds by radio methods	Mr. J. A. Ratcliffe, Cambridge.
VI	Research using rocket-borne equipment	
	VI.1 Photometric study of night airglow and day airglow in the optical field and search for micrometeoric material by microphonic method	Professor D. R. Bates, Queens University, Belfast.
	VI.2 Study of atmospheric pressure, temperature and wind distribution: study of ionic constitution of ionised layers	Professor H. S. W. Massey, Dr. R. L. F. Boyd, University College, London.
	VI.3 Measurement of ion density	Professor J. Sayers, University of Birmingham.
	VI.4 Study of distribution of electron density	Dr. W. J. G. Beynon, University College, Swansea, and R.A.E.
	VI.5 Study of wind-structure by optical and radar methods	Professor P. A. Sheppard, Imperial College.
	VI.6 Photography of ultra- violet image of sun	R.A.E.
	VI.7 Development of a rocket-borne magnetometer	R.A.E.